

1011741



# PATENT SPECIFICATION

DRAWINGS ATTACHED

1011741

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Int. Cl.:—B 24 b, d

## COMPLETE SPECIFICATION

### Improvements in apparatus for Grinding and Polishing Curved Surfaces of Glass Articles

We, PHILIPS ELECTRONIC AND ASSOCIATED INDUSTRIES LIMITED, formerly Philips Electrical Industries Limited, of Abacus House, 33 Gutter Lane, London, E.C.2, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to apparatus for grinding and polishing curved surfaces of glass articles, for example the screens of cathode-ray tubes, which apparatus comprises a flexible rotatable disc-shaped carrier which on one side is provided with grinding or polishing means and which on the other side is provided with means for applying to the surface of the glass article a load distributed substantially evenly over the whole of the carrier. Such an apparatus is described and claimed in our co-pending Application No. 30251/61 (Serial No. 979,058).

In the arrangement as described with reference to the drawings in this co-pending Application the load is formed by a mass contained in a flexible envelope supported on the upper side of the carrier, this flexible envelope being secured by chains to the driving member of the carrier, since otherwise it would be excessively deformed in operation. The apparatus yields good results.

The apparatus may further be improved, according to the present invention, by deriving the load from a preferably annular loading plate, which, with the interposition of a fluid-filled, preferably also annular envelope of an elastic material such as rubber rests on the flexible carrier. Thus a still more uniform distribution of the operative pressure on the surface to be worked can be attained, so that a very uniform abrasion of the material is obtained.

The loading plate may be arranged so as to be displaceable in the direction of the axis

[Price

of rotation of the carrier. In this case the loading plate bears with its own weight on the gas- or liquid-filled container which distributes the pressure uniformly over the flexible carrier and from there over the surface to be worked, and the loading plate must then be comparatively heavy and thick: It is preferred to have the driving member of the elastic carrier rest on compression springs supported on the loading plate.

In another embodiment a driving member of the flexible carrier bears directly on the loading plate. The driving member exerts directly a force on the loading plate which, in turn distributes this force, through the gas- or liquid-filled container, over the carrier and hence over the surface to be worked in a uniform manner. With this embodiment the loading plate may be comparatively light and thin.

Preferably, the annular container has a cross section which matches the curvature of the surface of the object to be treated: the cross section may be trapezoidal.

In order to avoid the driving member exerting an excessive pressure on the centre of the carrier, the latter may have a recess into which the driving member can resiliently be received.

Embodiments of the invention will now be described with reference to the accompanying diagrammatic drawings, wherein:

Figures 1 and 2 show in sectional views curved faces.

Figures 3 and 4 are a plan and a side elevation respectively of an embodiment suitable for working on the face of a television tube.

In the embodiment shown in Figure 1 a circular carrier 1 carrying grinding or polishing plates 2 consists of elastic material, for example foam rubber or a foam plastic material. At the centre of the carrier 1 on the side thereof remote from the plates 2, is a circular recess 3 covered by a thin disc 4 connected

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around its edge to the carrier 1 and also made from elastic material, for example a thermoplastic synthetic substance. The driving member 6 of the carrier 1 is secured to said disc 4 by screws, not shown, and a metal ring 5. The driving member 6 comprises a sleeve 7, to the lower end of which is secured a universal joint 8 which can be driven by driving gear not shown, this driving gear being arranged to rotate the carrier 1 through the universal joint 8 and the sleeve 7. Grinding or polishing fluid can be fed to the working surface through openings 9 in the bottom of the sleeve 7 and openings 10 in the disc 4 and carrier 1.

On the carrier 1 is loosely disposed a rubber ring 11 filled with fluid, for example air; the cross section of this ring is substantially in the form of a trapezoid, so that the ring can follow the curvatures the surface of the carrier and of the article to be treated. The sleeve 7 locates the rubber ring 11 in position. On the ring 11 bears an annular loading plate 12 of iron or a similar heavy material, which is held by a key 13 to the rotating sleeve 7 and is displaceable along the axis of rotation. The weight of the loading plate 12 is uniformly distributed through the air-filled ring 11 over the upper surface of the carrier 1, so that the latter can exert a uniform operative pressure on the surface to be treated, which is conducive to a uniform abrasion of that surface.

In order to prevent the penetration of the polishing fluid to the inner and lower surfaces of the plate 12 and ring 11, a rubber sealing ring 14 is held by a ring 15 to seal the annular gap between the plate 12 and the sleeve 7.

An annular disc 17 around the sleeve 7 abuts against a safety ring 18 which locks into one of a number of grooves 16 formed in the sleeve 7. The opposite side of the disc 17 is spaced by a plurality of compression springs 19 from the loading plate 12 which thus assists in supporting the driving member 3. The spring pressure can be adjusted by locating the ring 18 in a suitable groove 16 so as to avoid excessive pressure of the sleeve 7 on the elastic carrier 1. However, should the sleeve 7 press too far downwardly, it would be received in recess 3 on the upper side of the carrier 1, so that the sleeve 7 is inhibited from abutting against the carrier 1 and thus a considerable variation in the pressure distribution is avoided. The sleeve 7 is urged back out of the recess 3 by the springs 19.

The embodiment shown in Figure 2 is constructed in a manner similar to the embodiment illustrated in Figure 1 and similar parts are designated by the same reference numerals. In this embodiment there is no universal joint, its place being taken by a

rigid driving shaft 21. A loading plate 22, which is considerably thinner and lighter than the plate 12 in Figure 1, bears, with the interposition of a seal 23, against the safety ring 18 of the driving member 6. The driving member thus exerts through the driving shaft 21, the sleeve 7 and the ring 18 a pressure on the loading plate 22 which pressure is uniformly distributed over the carrier 1 by means of the air-filled ring 11. Consequently, by causing the driving member to exert a greater or smaller thrust, the operative pressure can be adjusted at will.

In the embodiment shown in Figures 3 and 4 the glass face plate 26 of a television tube is disposed on a rotatable table 25 so that its surface can be polished by means of the apparatus shown in Figure 1. The table 25 and the carrier 1 are rotated in opposite directions, as indicated in Figure 3 by arrows. The axis of rotation of the polishing apparatus is inclined at an angle  $\alpha$  to the axis of rotation of the table 25, so that the same operative pressure is exerted on each point of the overall surface of the face plate 26. Since owing to the mainly rectangular shape of the face plate the carrier 1 extends partly beyond the edge of the face plate, supports 27 for example of hard material may be disposed, if necessary, on the table 25 along the longer sides of the display screen 26, so that the supports have the effect of increasing the area of the article to be worked.

#### WHAT WE CLAIM IS:—

1. Apparatus for grinding and polishing curved surfaces of glass articles as claimed in Claim 1 of co-pending Application No. 30251/61 (Serial No. 979058), wherein the load is derived from a loading plate which, with the interposition of a fluid-filled envelope of an elastic material such as rubber rests on the flexible carrier.

2. Apparatus as claimed in Claim 1, wherein the loading plate is annular.

3. Apparatus as claimed in either preceding Claim wherein the fluid-filled envelope is annular.

4. A device as claimed in any preceding Claim, wherein the loading plate is displaceable in the direction of the axis of rotation of the carrier.

5. A device as claimed in Claim 4, wherein a carrier-driving member rests on compression springs supported on the loading plate.

6. A device as claimed in Claim 1, Claim 2 or Claim 3, wherein a carrier-driving member rests directly on the loading plate.

7. A device as claimed in any preceding Claim, wherein the flexible envelope has a cross-section which can follow the curvature of the surface of the object to be treated.

8. A device as claimed in Claim 7, wherein

the cross section of the flexible envelope is trapezoidal.

- 5 9. A device as claimed in any preceding Claim, wherein the flexible carrier has a recess which can resiliently receive the end of a carrier-driving member.

- 10 10. Apparatus as claimed in Claim 1, substantially as described herein with reference to Figure 1, Figure 2 or Figures 3 and 4 of the accompanying drawings.

- 15 11. A method of grinding or polishing with the aid of an apparatus as claimed in any preceding Claim, wherein both the article to be treated and the carrier are rotatable, and wherein the rotary movements of the article and of the carrier have opposite directions.

12. A method as claimed in Claim 11,

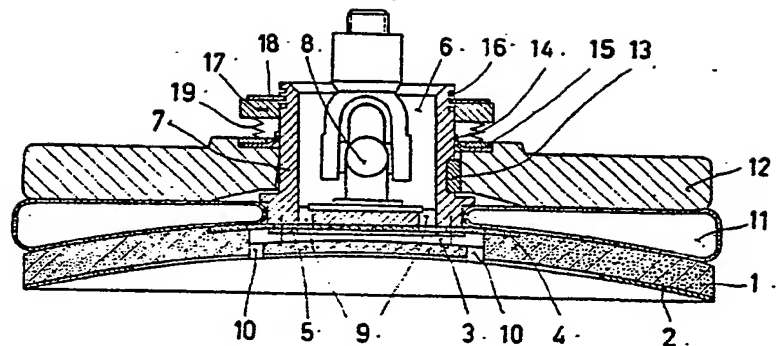
wherein the rotary axis of rotation of the carrier is arranged obliquely to the axis of rotation of the article to be treated.

- 20 13. A method as claimed in Claim 12, wherein supports are provided along sides of the article to be worked, said supports forming having the effect of increasing the area of the face to be worked.

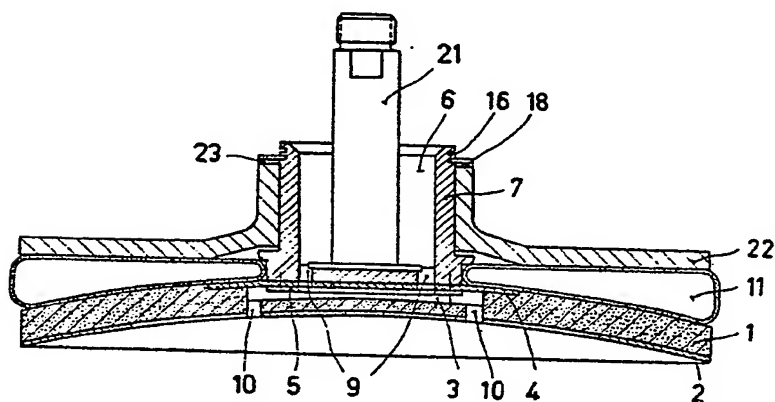
- 25 14. A method of grinding or polishing with the aid of apparatus as claimed in any of Claims 1 to 10, substantially as herein described.

T. D. THREADGOLD,  
Chartered Patent Agent,  
Century House, Shaftesbury Avenue,  
London, W.C.2.  
Agent for the Applicants.

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**FIG. 1**



**FIG. 2**

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2 SHEETS

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the Original on a reduced scale*

Sheets 1 & 2

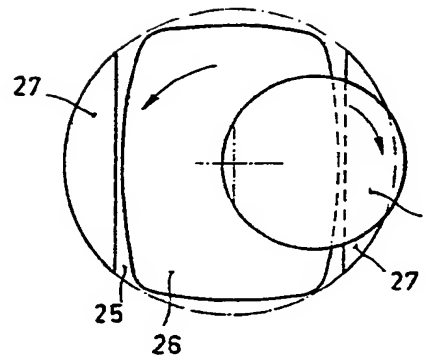
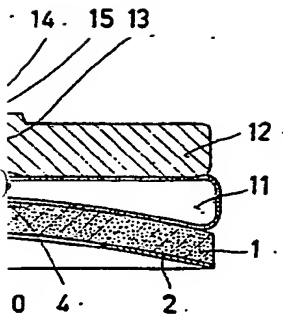


FIG.3

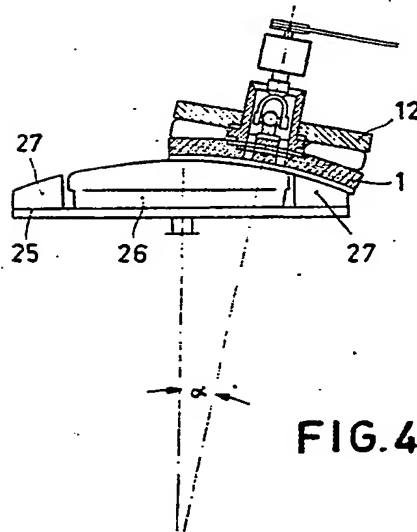
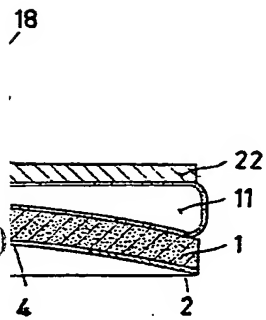


FIG.4

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 Sheets 1 & 2

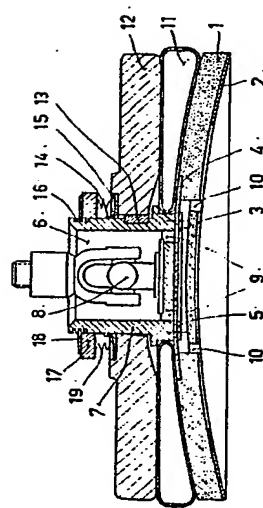


FIG. 1

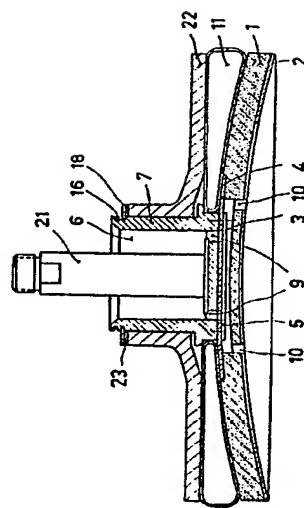


FIG. 2

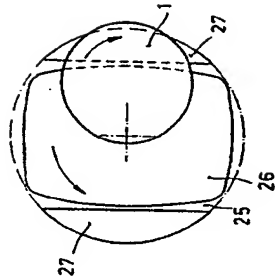


FIG. 3

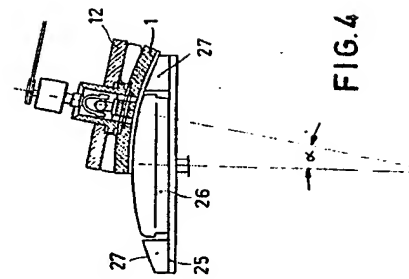


FIG. 4